SOLVING MANUFACTURING AND SERVICE CHALLENGES WITH AR

Marc Schuetz
VP, Vuforia Product Management

November 28, 2018

ptc | forum europe

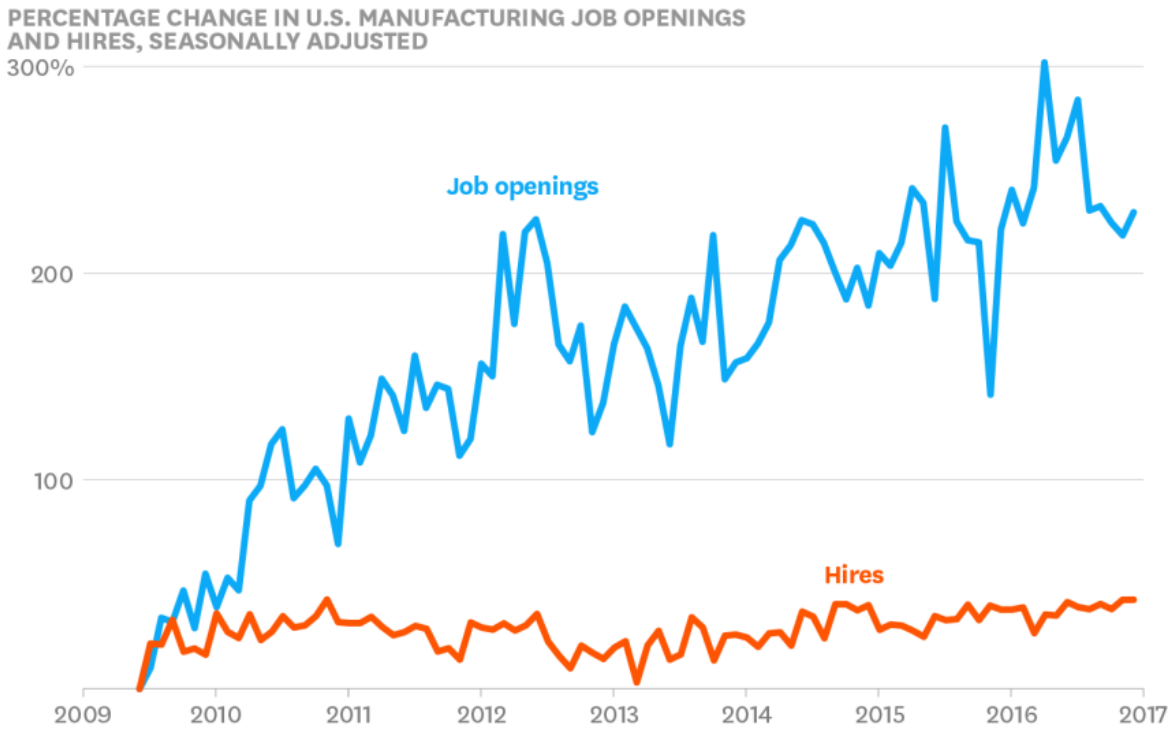
ptc

"Augmented reality isn't some pie-in-the-sky technology that's coming someday soon. It's here now, and it's driving real-world use cases that will have industry-shaking ramifications in the very near future."

Tom Mainelli
Program Vice President,
Devices & AR/VR

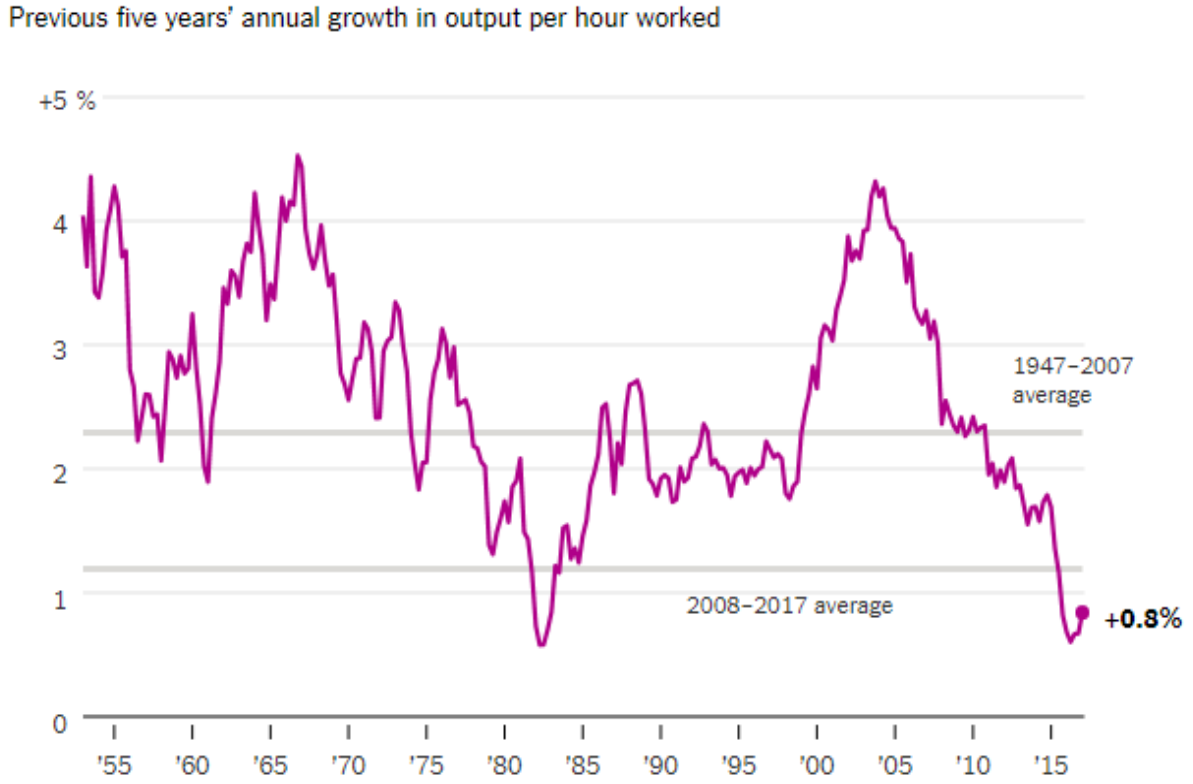
IDC | ANALYZE THE FUTURE

MARKET PRESSURE IN MANUFACTURING AND SERVICE



The growing shortage of skilled manufacturing workers

Source: U.S. Bureau of Labor Statistics



Productivity growth is the weakest since early 1980s

Source: U.S. Bureau of Labor Statistics

MARKET PRESSURE IN MANUFACTURING AND SERVICE

ptc

Disappearing Workforce

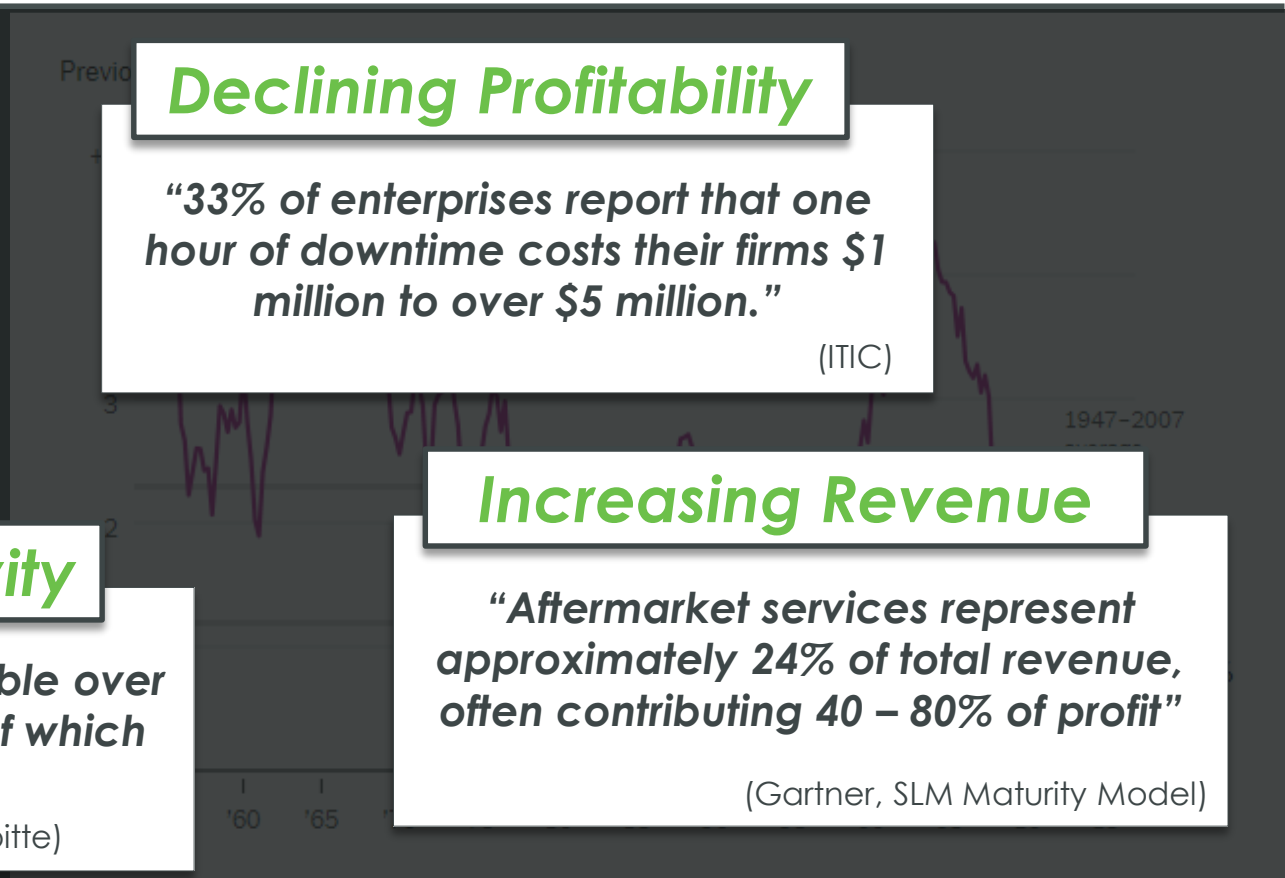
"Over the next two decades the global economy faces the largest exodus from the workforce of any generation history"

(Deloitte)

Manufacturing Productivity

"3.5 million manufacturing jobs available over the next decade in the US, 2 million of which will go unfilled."

(Deloitte)



Declining Profitability

"33% of enterprises report that one hour of downtime costs their firms $1 million to over $5 million."

(ITIC)

Increasing Revenue

"Aftermarket services represent approximately 24% of total revenue, often contributing 40 – 80% of profit"

(Gartner, SLM Maturity Model)

The growing shortage of skilled manufacturing workers

Productivity growth is the weakest since early 1980s

Source: U.S. Bureau of Labor Statistics

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ANALYSTS: AR DELIVERS AGAINST THESE PRESSURES

Capgemini

Operational benefits of ≥10% are realized by 76% of companies with large-scale AR in areas such as **productivity**, **efficiency**, **safety**

1. Capgemini, Augmented and Virtual Reality in Operations: A guide for investment, September 2018. 2. IDC, Tom Mainelli, White Paper: How Augmented Reliability Drives Real-world Gains In Services, Training, Sales And Marketing, And Manufacturing. May 2018. 3. Aberdeen, Tom Paquin, Best-in-Class Augmented Reality Studies. September 2018

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ABERDEEN GROUP

Companies who use AR see year-over-year business growth:
29% gross margin lift, 17% revenue lift, 14% customer retention lift

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IDC

Manufacturing benefits:

- ✓ Increased efficiency (70%)
- ✓ Decreased training time (60%)
- ✓ Improved accuracy (42%)

Services benefits:

- ✓ Improved knowledge transfer (66%)
- ✓ Employees more efficient (60%)
- ✓ Effectiveness / first-time-fix-rates (50%)

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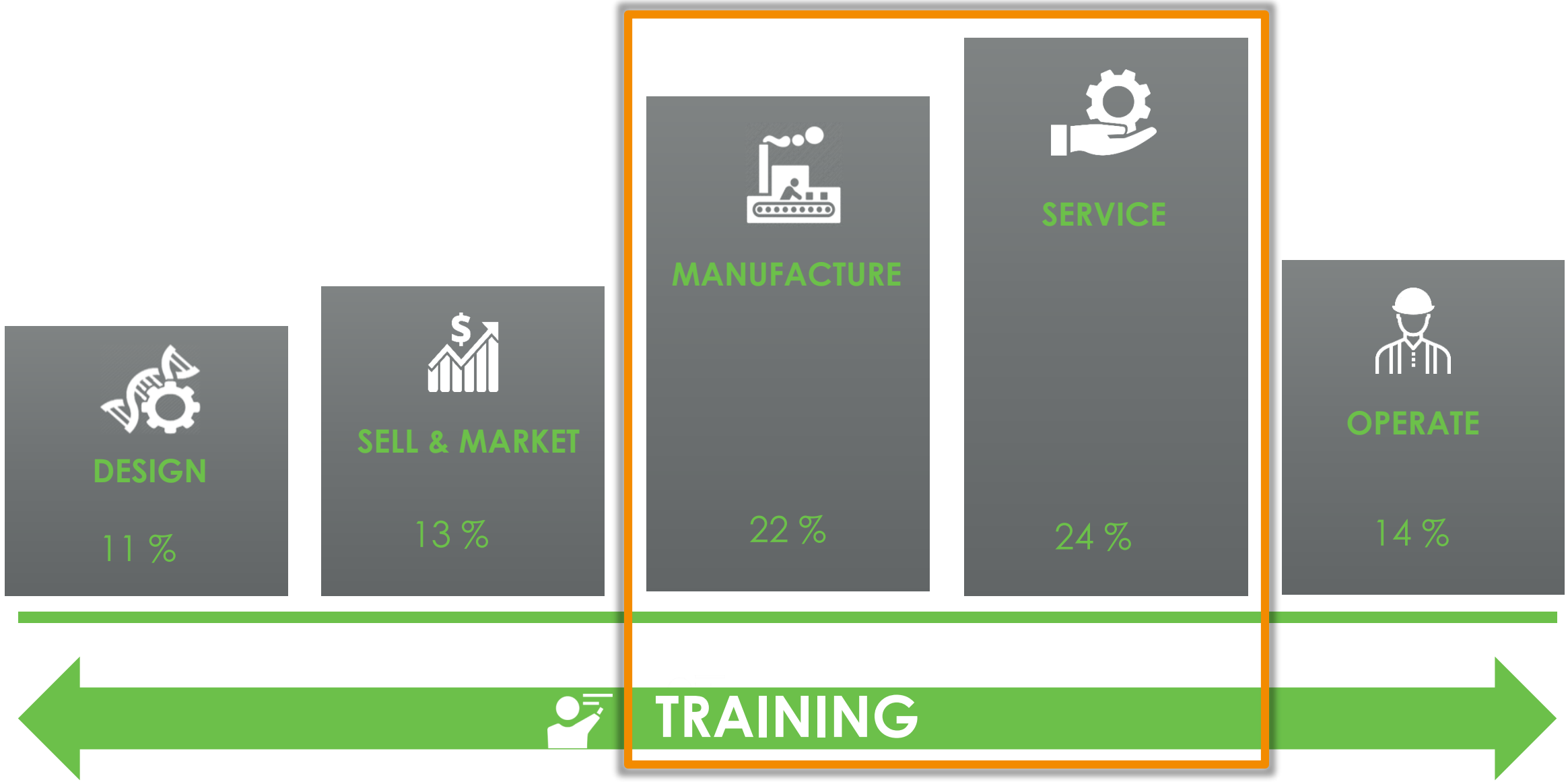
AR OPPORTUNITIES ACROSS THE VALUE CHAIN



Note: These use cases cover 98.67% of responses. The remaining belongs to Other use cases.

Sample of 195 companies
Average of 5 use cases and 2.2 functional areas chosen per respondent

KEY USE CASES

MANUFACTURE

Augmented Work Instruction
Step-by-step assembly, maintenance & changeover instructions

✓ **Faster Ramp-Up Time & Improve Efficiency**

Remote Expert Guidance
Annotated real-time guidance and problem solving

✓ **Improve Communication & Reduce Downtime**

SERVICE

Augmented Service Instructions
Step-by-step repairs and part disassembly/reassembly instructions

✓ **Improve Effectiveness & Lower Service Costs**

Remote Expert Guidance
Over-the-shoulder collaboration and support

✓ **Speed Troubleshooting & Lower Travel Costs**

Augmented Training
Virtual product demonstration and in–context instructions

✓ **Close the Skills Gap and Reduce Time & Cost of Onboarding**

MANUFACTURING USE CASE SCENARIOS

MANUFACTURE

Augmented Work Instruction

Step-by-step assembly, maintenance & changeover instructions

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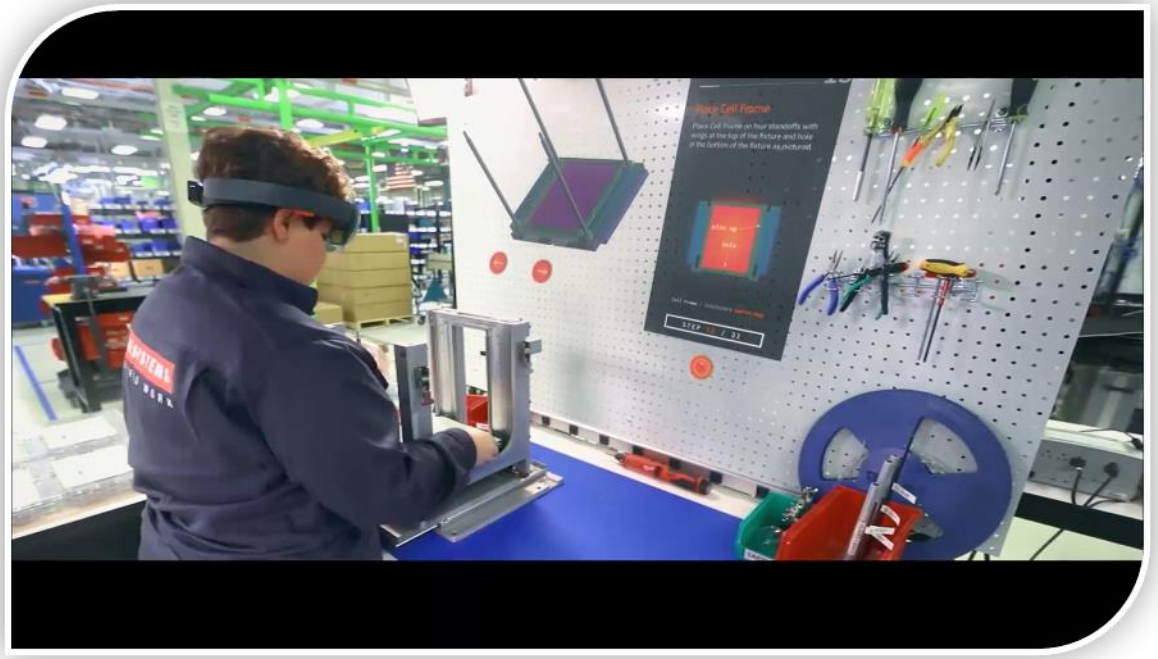
INCREASED EFFICIENCY IN MANUFACTURING

50% FASTER ASSEMBLY

BAE SYSTEMS



"We created work instructions that we were able to **deliver to the production floor in hours**. And at a tenth of the cost."

Fran Piascik, BAE SYSTEMS
Senior Project Manager Engineering Innovation

Media #1 - BAE

BENEFITS FOR MANUFACTURING

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Manufacturing Productivity & Safety	Operational Efficiency & Profitability	Competitive Differentiation & Responsiveness
• **Improved efficiency** from accurate work instructions • **Scaling expertise** improves productivity & scalability • **Reduced complexity** of products & procedures • Better situational awareness **increases safety**	• Lower operational costs increases **profitability** • Increase machine **availability** and uptime • Drastically **reduced** time and cost of training • **Eliminates** need for a dedicated training asset	• Faster **revenue growth** relative to competition • **Efficiency** and **agility** improve responsiveness • **Higher quality** & yield rates meets customer demands • Less downtime improves **on-time delivery**

SERVICE USE CASE SCENARIOS

SERVICE

Augmented Service Instructions

Step-by-step repairs and part disassembly/reassembly instructions

✓ **Improve Effectiveness & Lower Service Costs**

Remote Expert Guidance

Over-the-shoulder collaboration and support

✓ **Speed Troubleshooting & Lower Travel Costs**

Augmented Training

Virtual product demonstration and in–context instructions

✓ **Close the Skills Gap and Reduce Time & Cost of Onboarding**

AUGMENTED SERVICE INSTRUCTIONS

cannondale®

Media #2 - Cannondale

CANNONDALE IMPROVES AFTER MARKET SERVICE WITH AR

IDENTIFY PARTS FOR EASIER PARTS ORDERING

Before

- Multiple, similar forks with similar components
- Challenges configuring equipment for optimal use

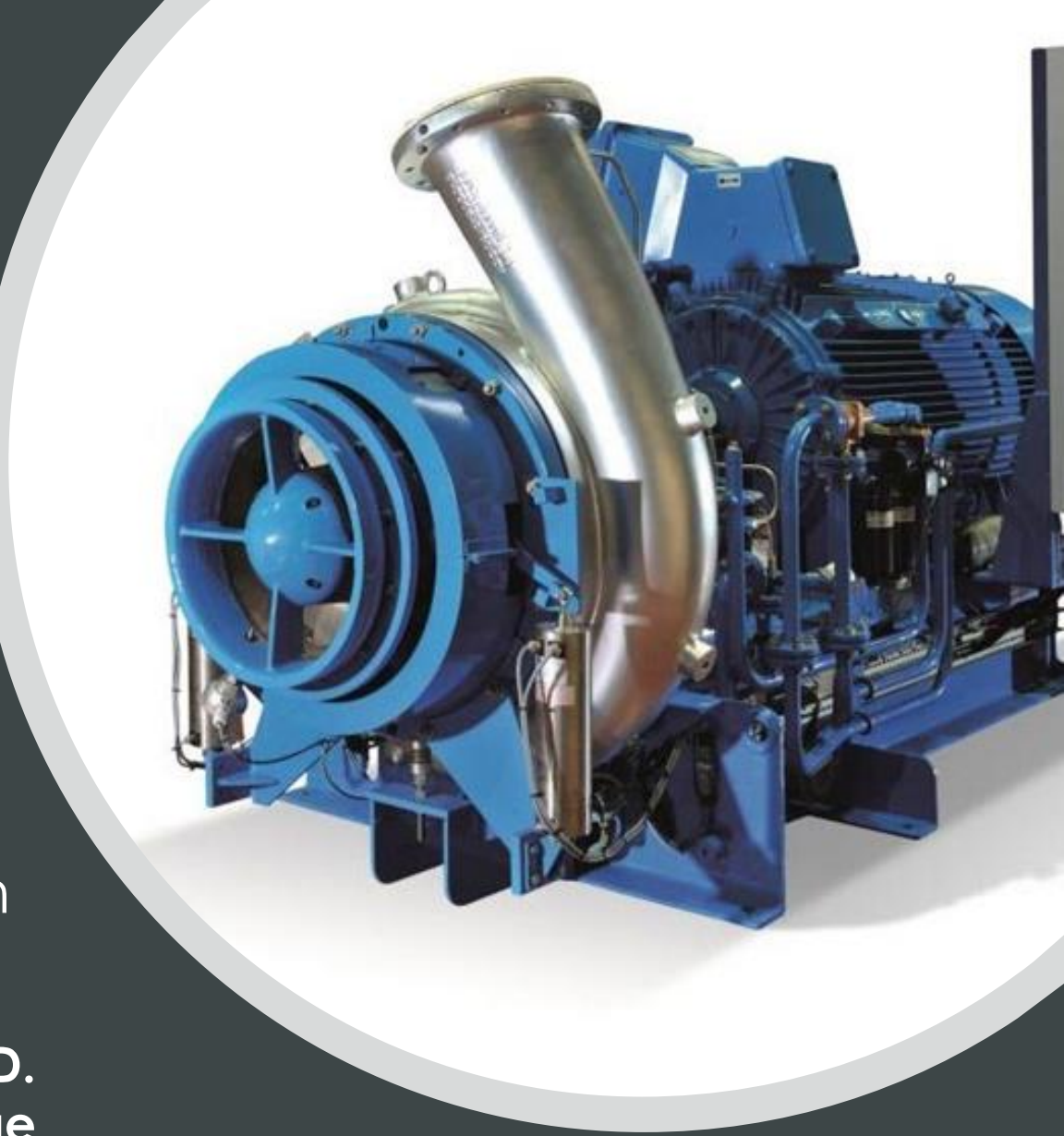
After with AR

- Deliver augmented reality experiences
- Identify components for easier order of replacement parts
- Improve user experience with configuration information (air pressure)

Howden

"With PTC and Microsoft we were able to jumpstart our digital transformation journey.

With technologies such as Vuforia Studio and Microsoft HoloLens, we found unique enablers that complement our digital twins and help us transform our customers' experience of owning Howden equipment."

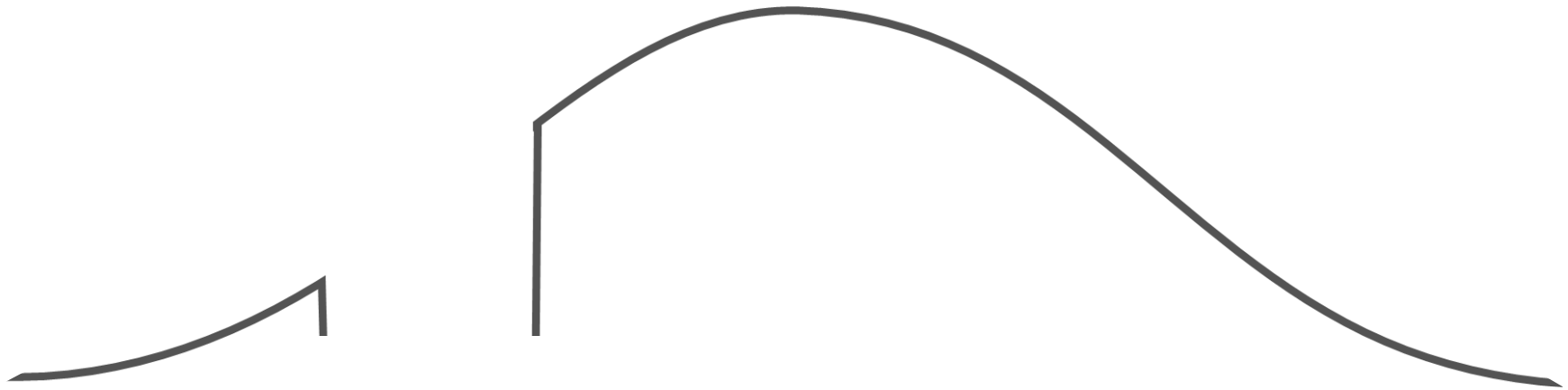


Maria Wilson, Ph.D.
Global Leader Data Driven Advantage
Howden Group

BENEFITS FOR SERVICE

Workforce Productivity & Safety	Operational Efficiency & Profitability	Revenue & Customer Satisfaction
• Access to accurate service content **improves efficiency**	• **Improved FTF** rates lower costs & increase margins	• **Increase service revenue** & contract renewals
• **Scaling expertise** improves productivity & scalability	• **Reduced errors** , downtime & penalties	• **Happy customers** due to faster problem resolution
• **Reduced complexity** of products & procedures	• **Less time** and cost for training and onboarding	• Value add services provide **competitive differentiation**
• Better situational awareness **increases safety**	• **Fewer part returns** & decreased handling cost	• Improved service reputation & **bottom line**

HOW TO SCALE AR ACROSS THE ENTERPRISE?



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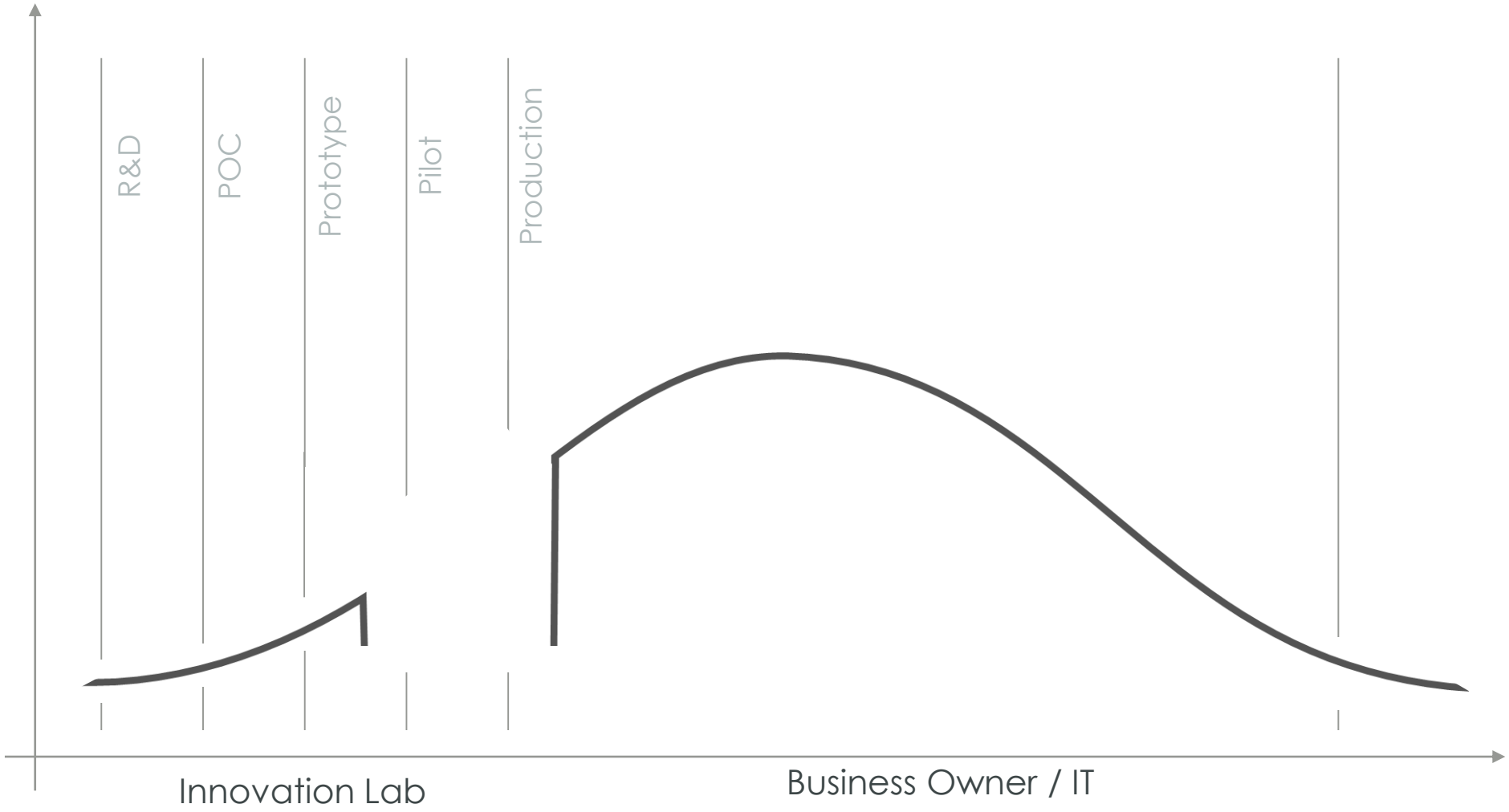

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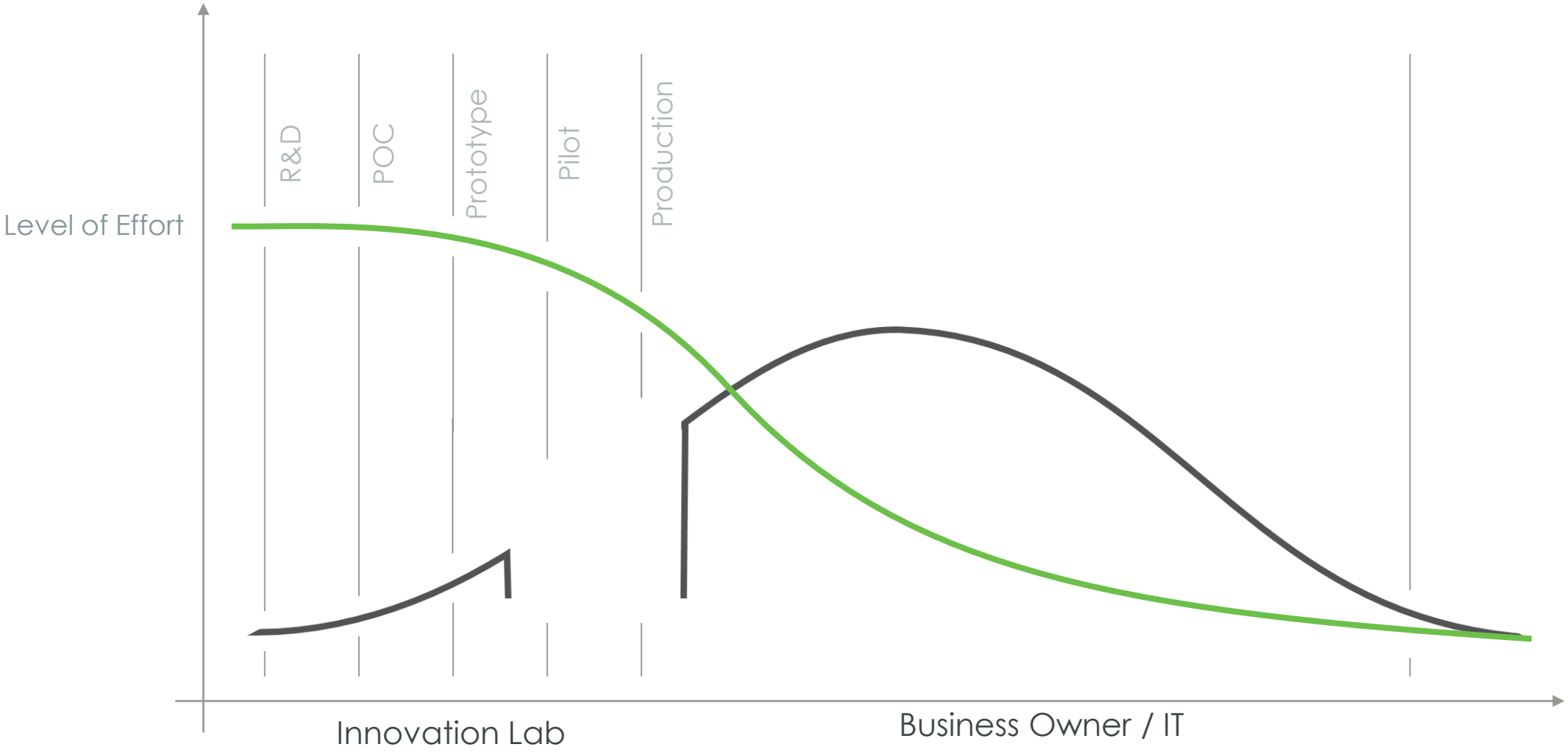

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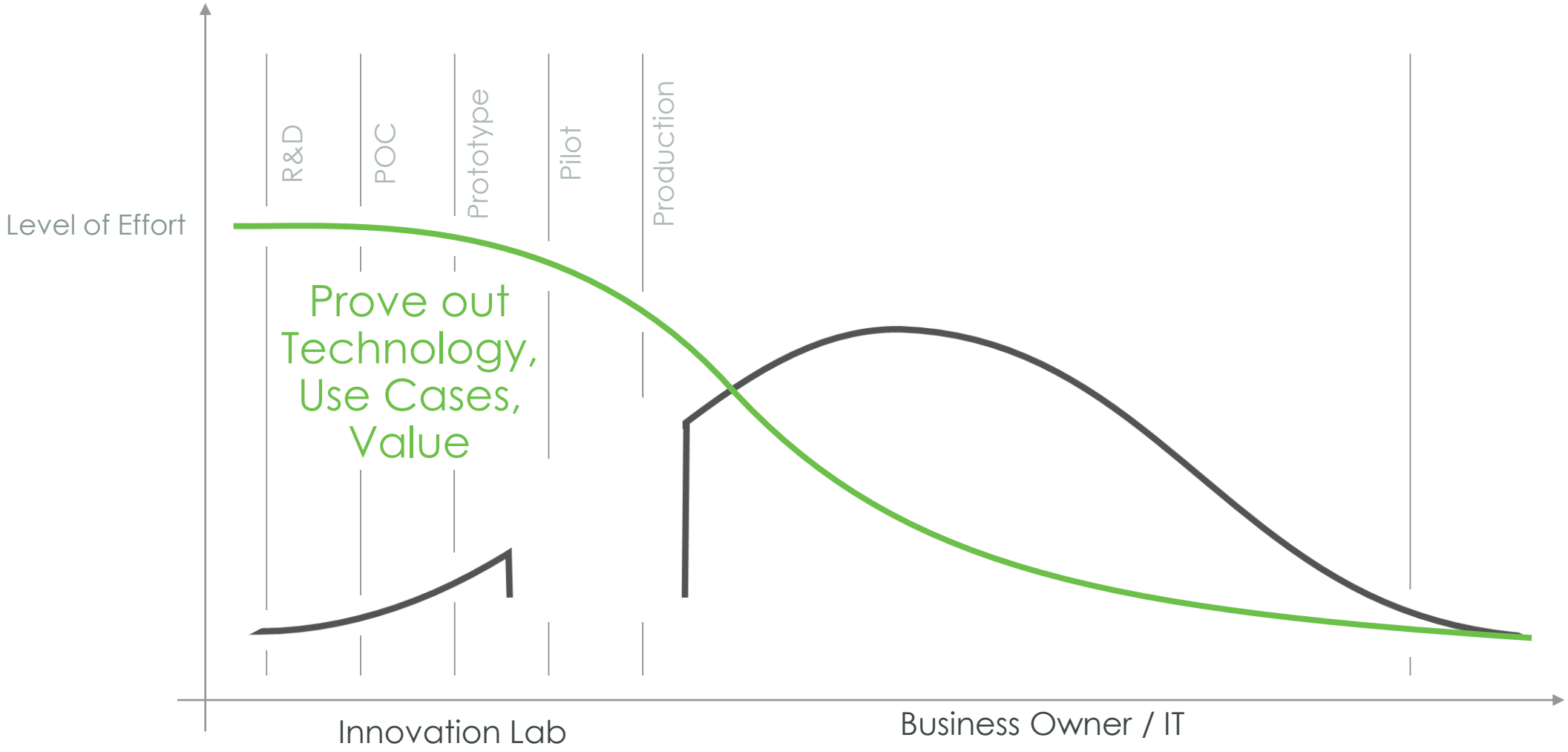

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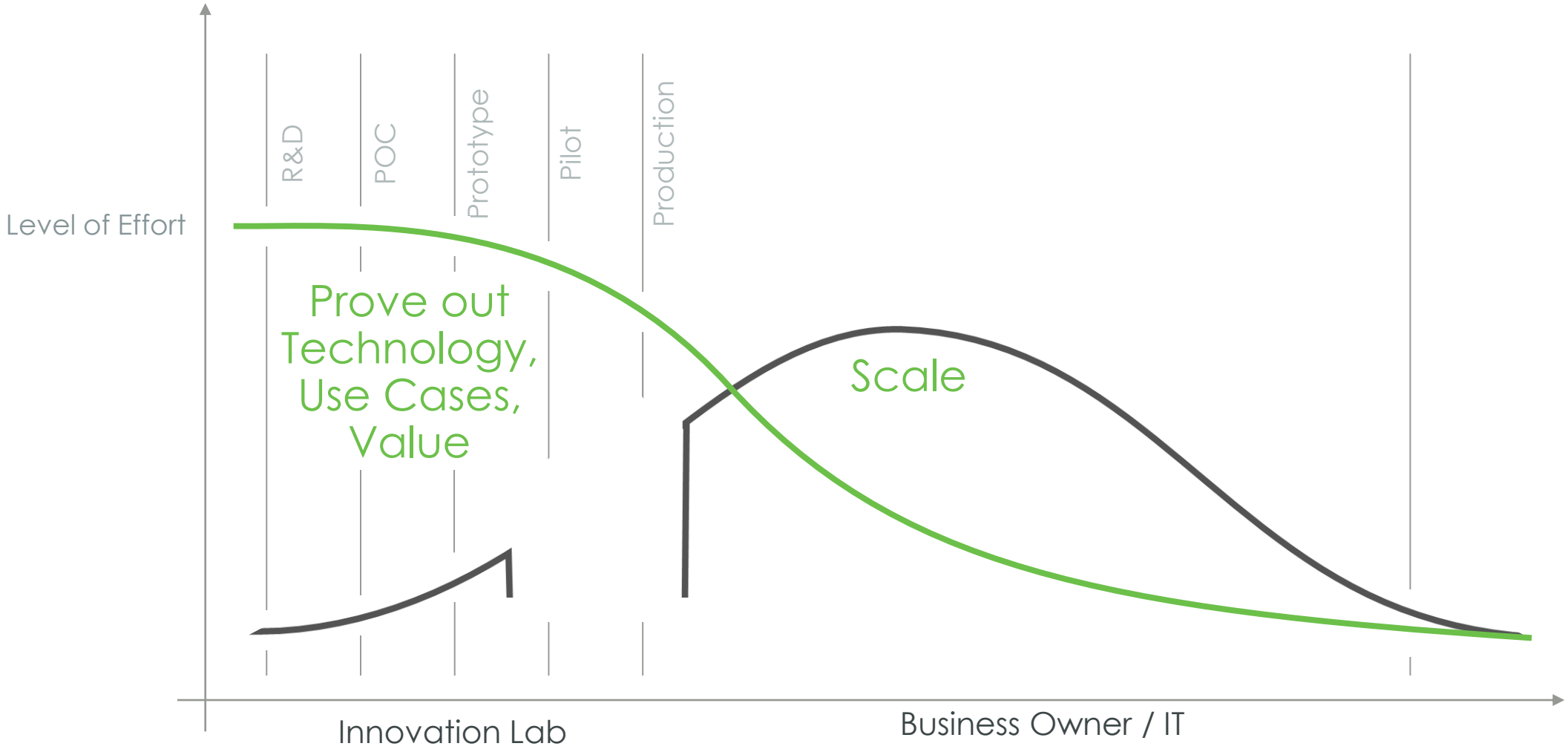

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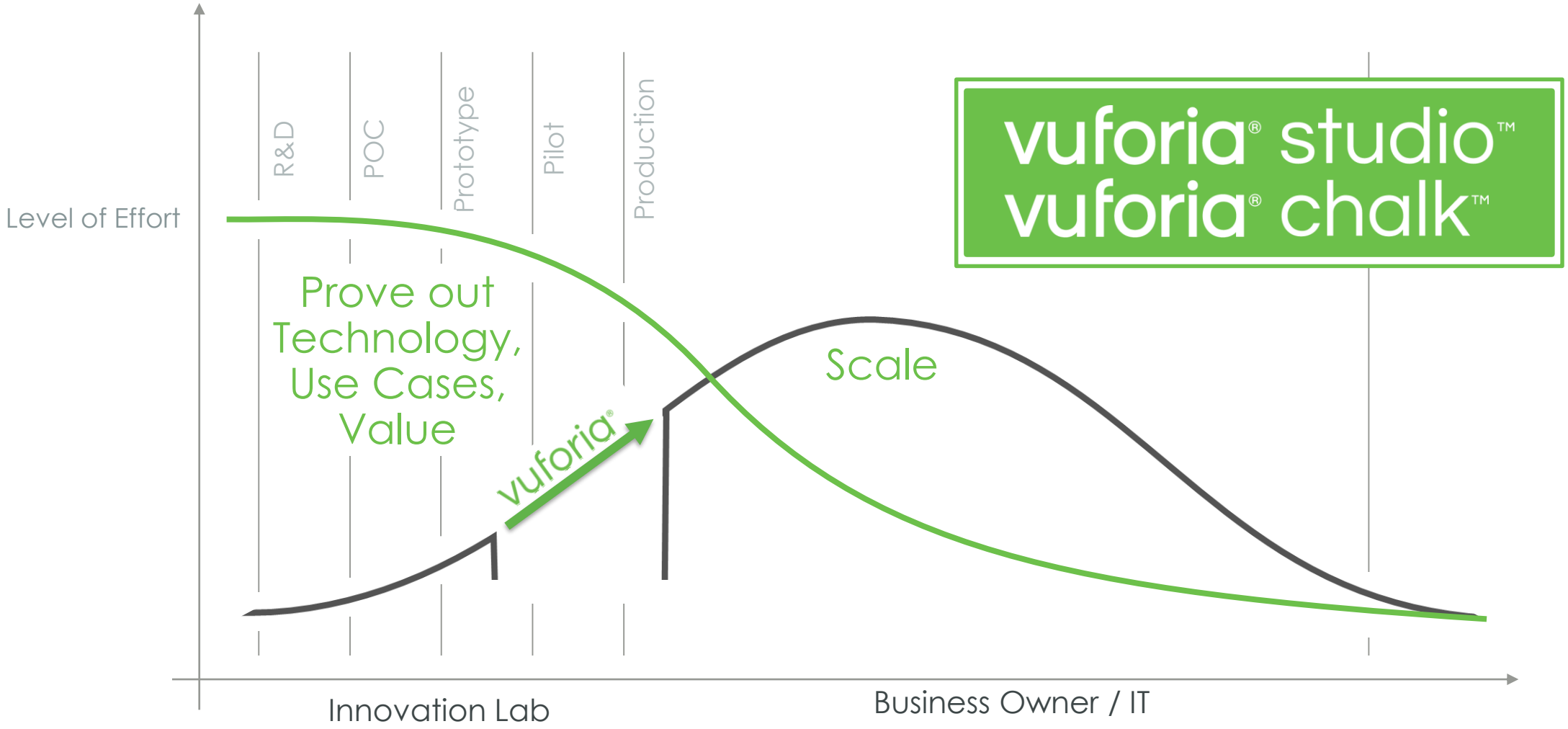
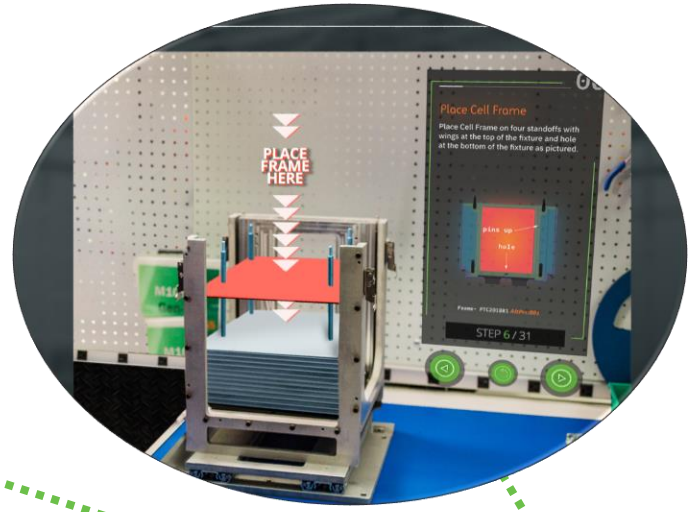


SCALABLE, EFFICIENT AR AUTHORING & PUBLISHING



Vuforia Studio - efficiently create scalable AR experiences for industrial use cases

Vuforia View - access and share AR experiences across the industrial enterprise

Media #3 – Studio Intro

SCALABLE, EFFICIENT AR AUTHORING & PUBLISHING

SECURE & FLEXIBLE DEPLOYMENT

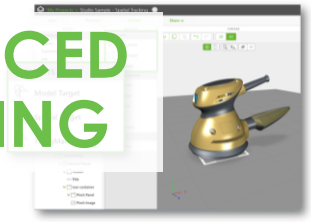
Vuforia Studio Experience Service is available cloud hosted and on-premises.

Vuforia Studio and Vuforia View for Windows10 and Android can be distributed offline or via SCCM.

ADVANCED TRACKING

Enhance user experiences by leveraging a variety of innovative tracking methods

- **Model Targets** - Recognize objects based on shape to improve service and operator efficiency
- **Spatial Targets** - Place 3D virtual products into real-world environments for designers and engineers
- **ThingMarks** - Identify individual products and experiences for precise overlay instructions



VIEW ON YOUR FAVORITE DEVICE

LOCALIZED

- Localization of
  - Vuforia Studio UI (Vuforia Studio, Installer, Vuforia View, License Agreement)
  - Documentation (HelpCenter, Install and Getting Started Guides and Procedures)
- Timeline
  - 02/2018 – Japanese
  - 03/2018 – German
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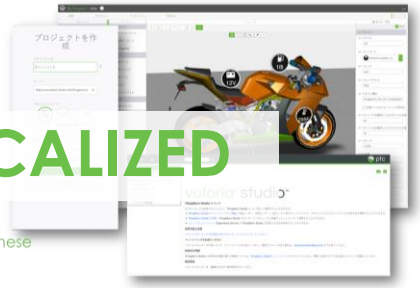

OFFLINE EXPERIENCE

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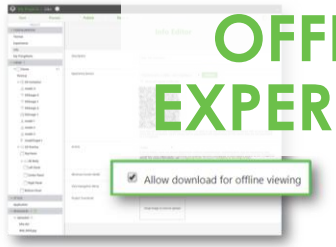


- Currently available on iOS, Android and Windows 10.
- HoloLens coming soon

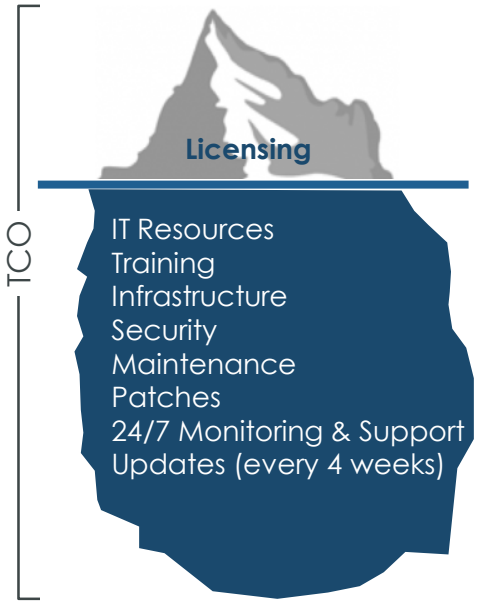
NATIVE IOT INTEGRATION

MOST SECURE AND FLEXIBLE DEPLOYMENT

Vuforia Studio Experience Service is available cloud hosted and on-premises.

Cloud Hosted

On-Premises



"Customers can spend up to four times the cost of their software license per year to own and manage their applications."

- Gartner
"The End of Software"

Vuforia Studio and Vuforia View for Windows10 and Android can be distributed offline or via SCCM.

VUFORIA STUDIO TARGETS

Enhance user experiences by leveraging a variety of innovative tracking methods

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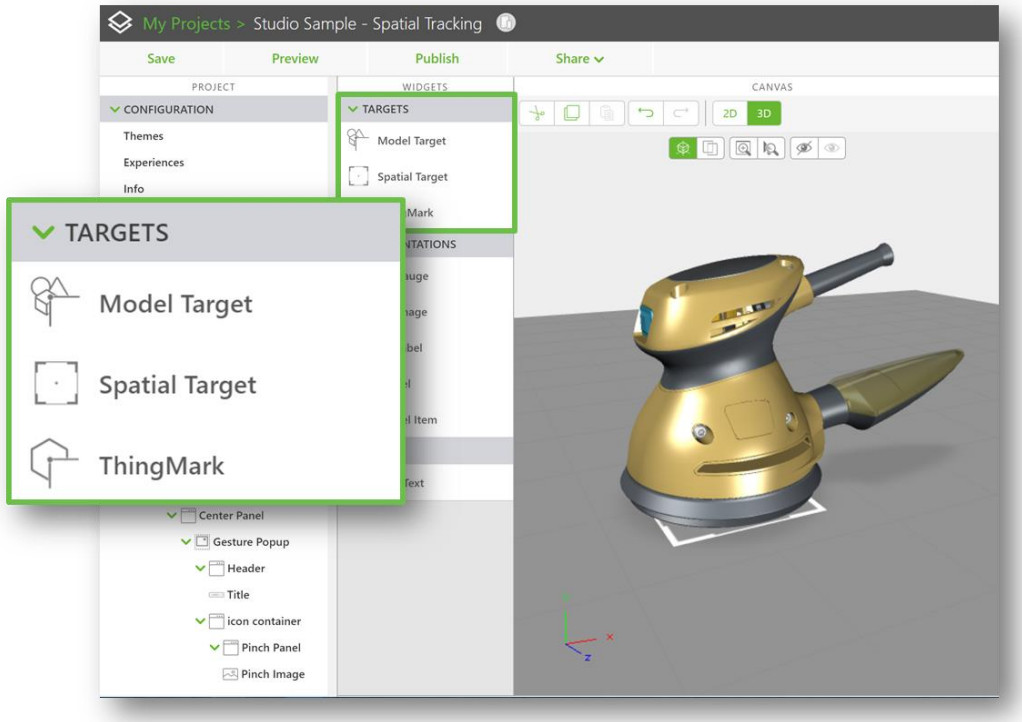
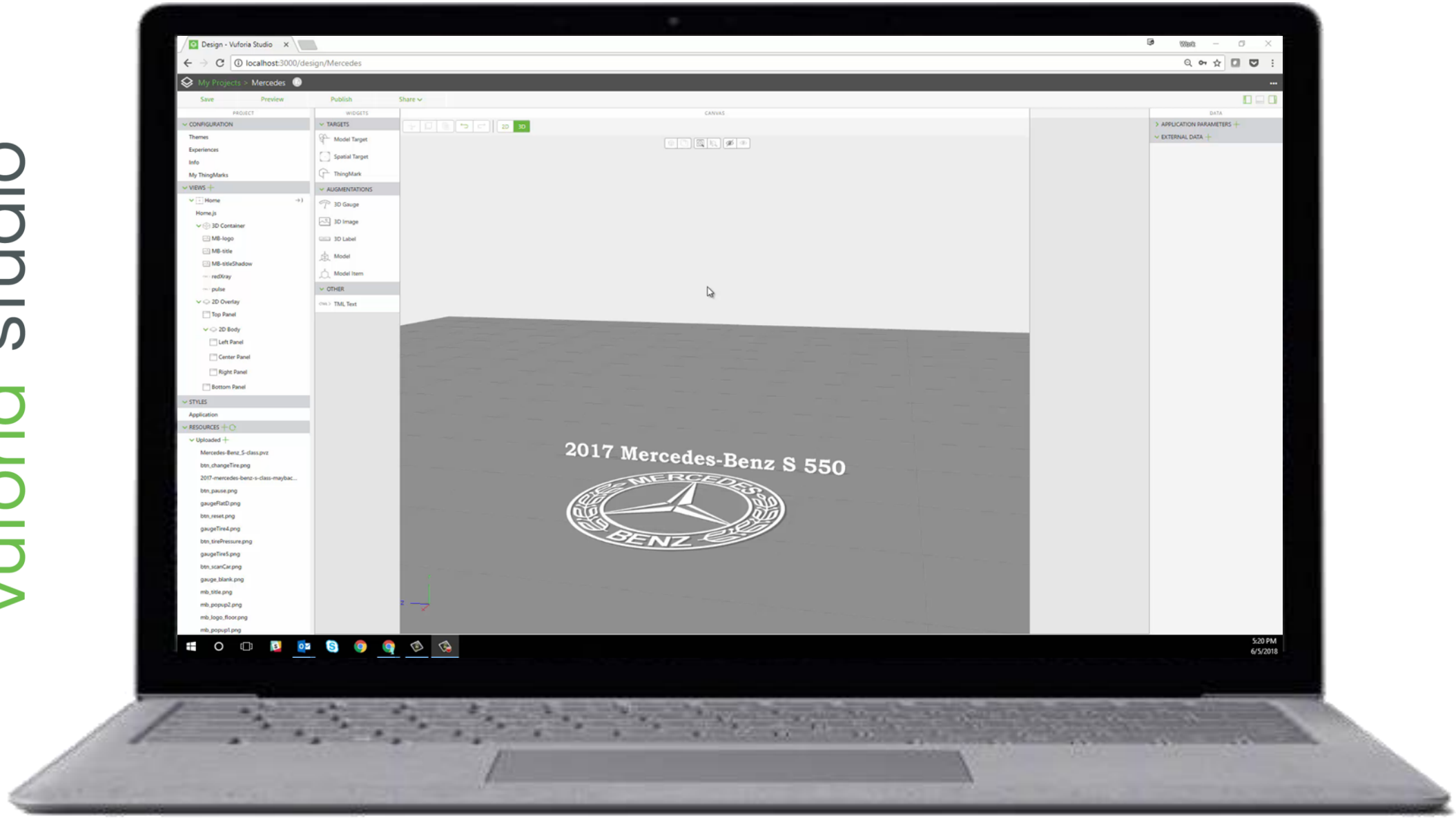


Advanced Tracking

MODEL TARGETS

vuforia® studio™



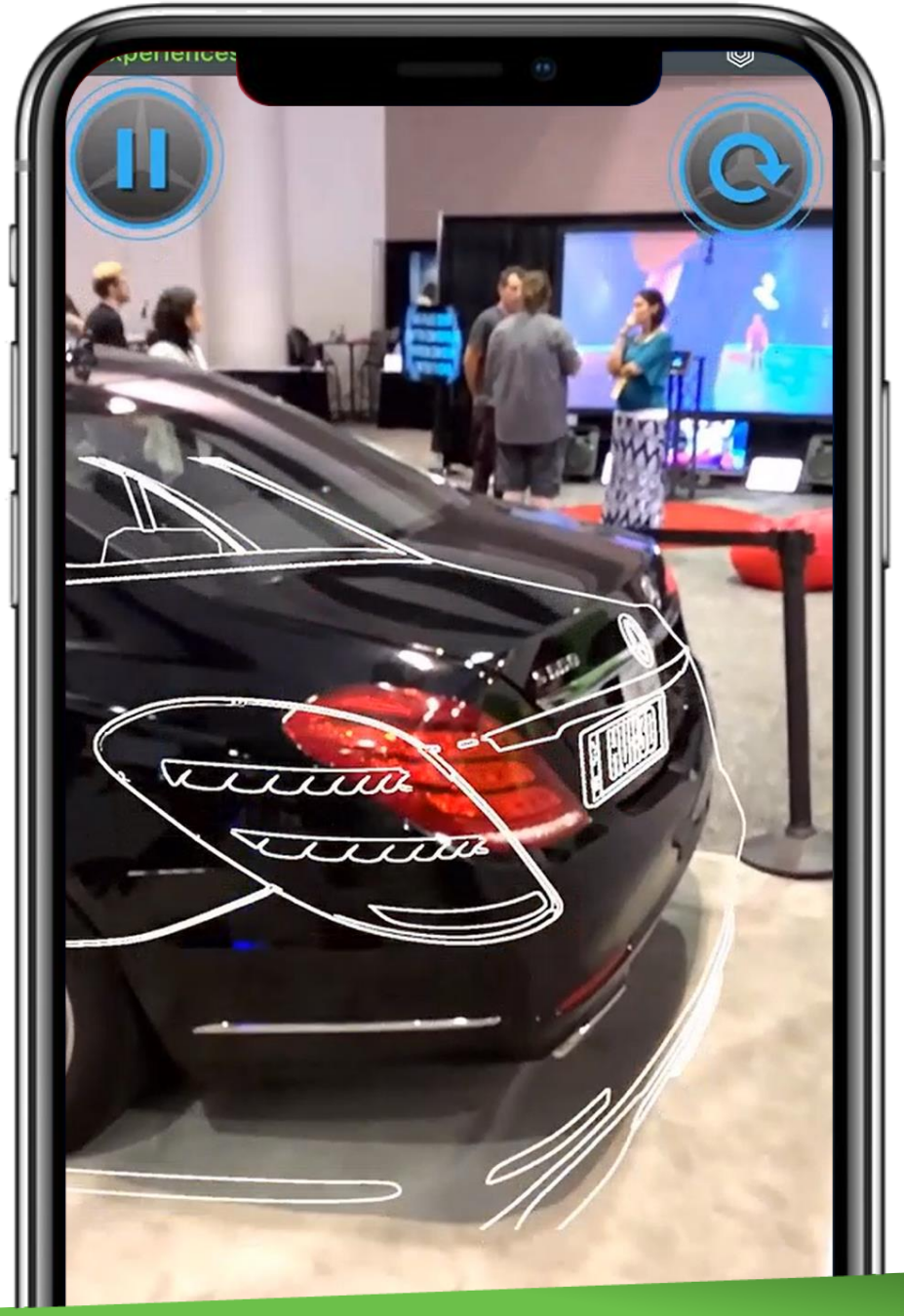
Media #4 – Studio MT

MODEL TARGETS

Model Targets enable physical objects to be recognized and tracked using a digital 3D model of the object.

Use Cases

- Work instructions on object
- Service procedures on object
- Operational procedures on object
- Training procedures on object
- Design Visualization on object



Media #5 – View MT

Media #6 – HoloLens MT

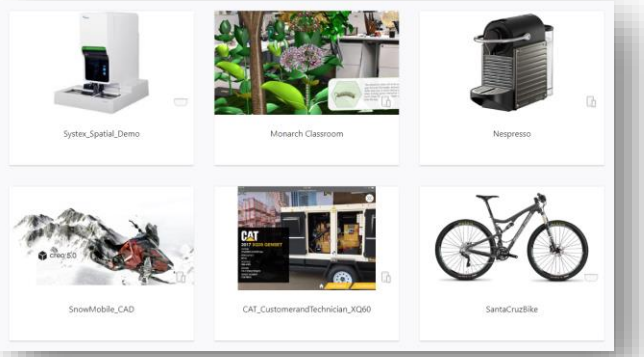
HOLOLENS ENHANCEMENTS

Configure Experience Service

Set your Experience Service URL by scanning a QR code

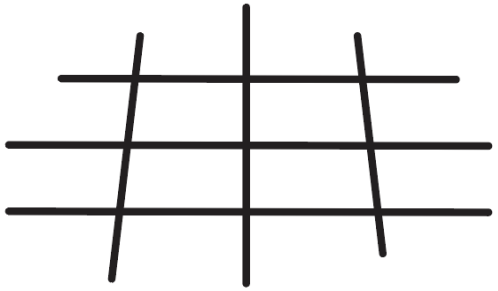
Experience Library

Load experiences from your Library



Spatial Tracking

Place 3D objects with Spatial Tracking



Gaze Indicators

Identify 3D objects with associated actions on the gaze icon

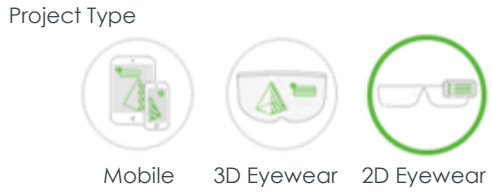
	Gaze	Air Tap
Experience space	·	○
Experience not clickable object	·	○
Experience clickable object	⊹	⊙

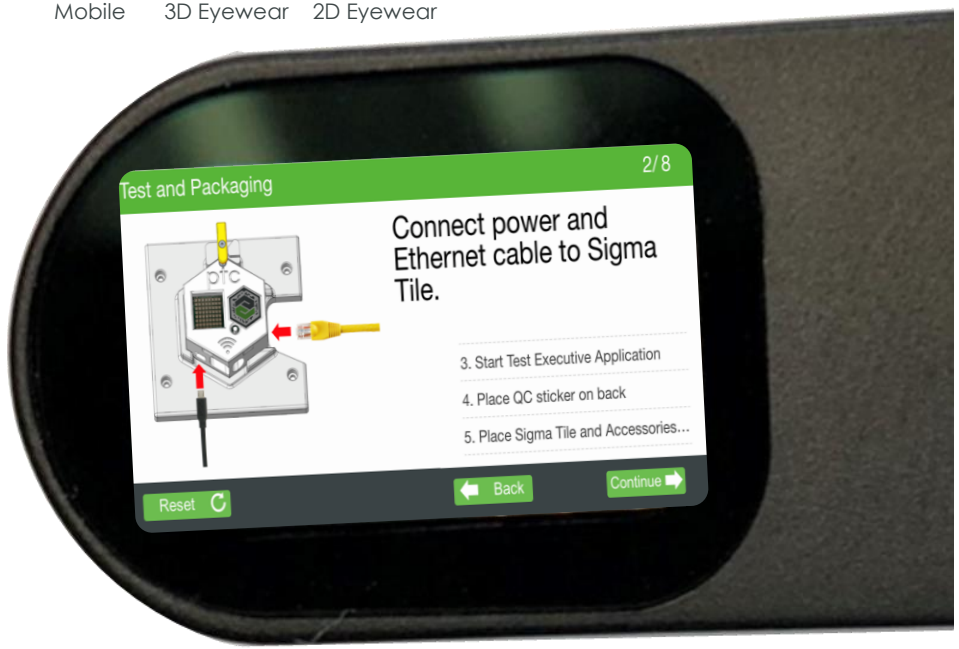
VUFORIA STUDIO FOR ASSISTED REALITY

Quickly and easily create experiences for head-mounted, tablet style devices

Improve the efficiency of your service technicians:

- Include **step-by-step instructions** in work procedures and workflows
- Quickly display **2D reference material** on-demand
- Provide **checklists** that can also save and store records of task/job completion





Assisted Reality

Media #9 – Studio AsR

VIEW EXPERIENCES ON YOUR FAVORITE DEVICE

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iOS Windows ANDROID

Mobile

Microsoft HoloLens

3D Eyewear

M300 VUZIX

realwear HMT-1

2D Eyewear

Media #7 – Pause/Resume

LOCALIZED

- Localization of
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    (Vuforia Studio, Installer, Vuforia View, License Agreement)
  - Documentation
    (HelpCenter, Install and Getting Started Guides and Brochures)
- Timeline
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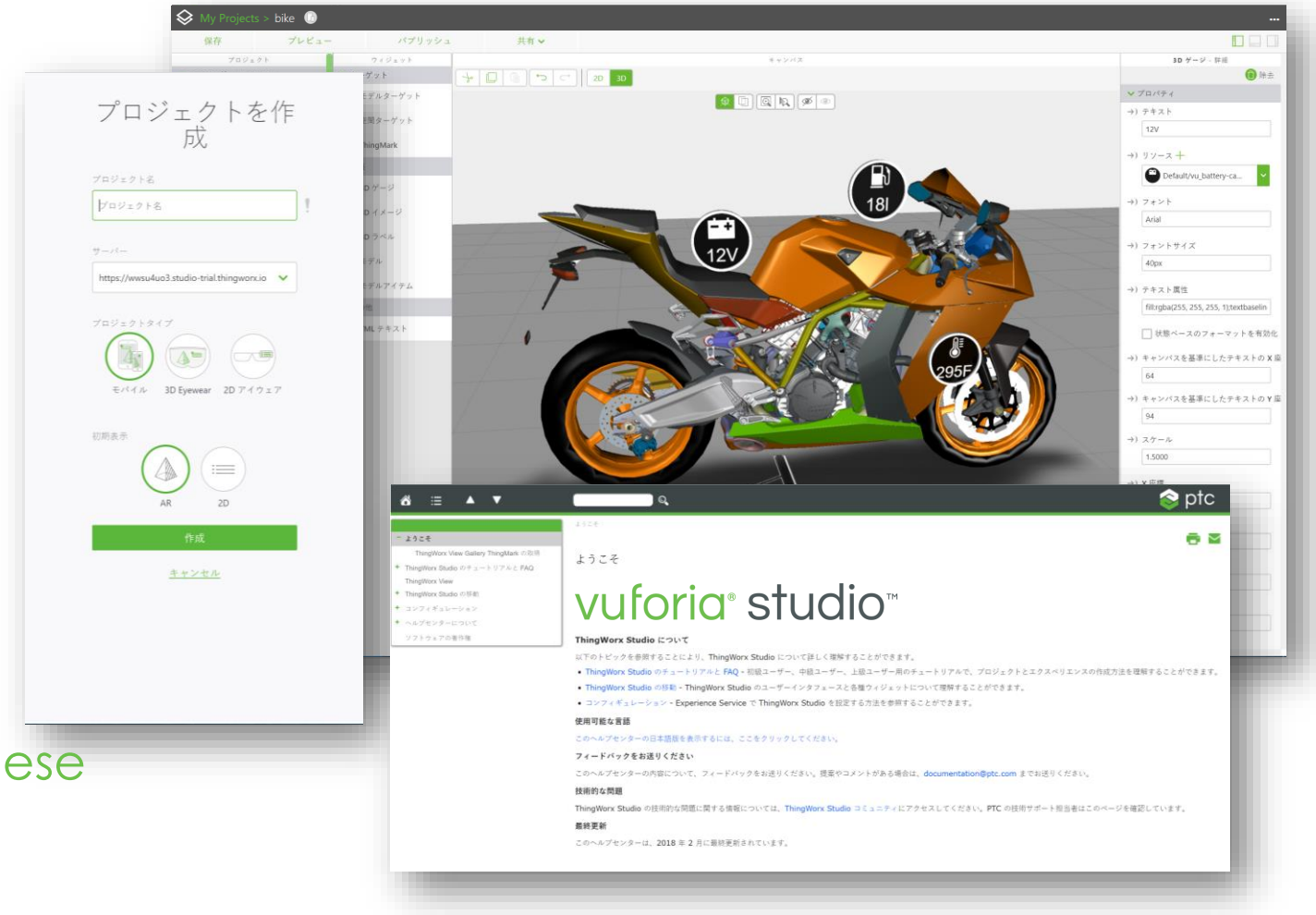

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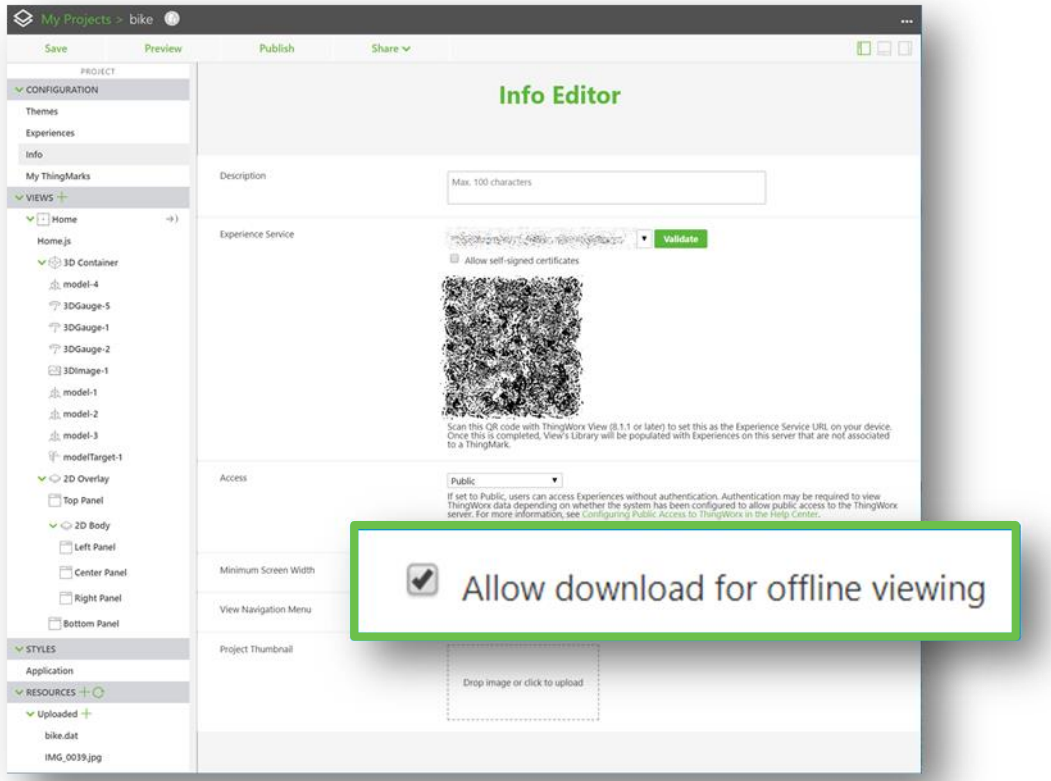
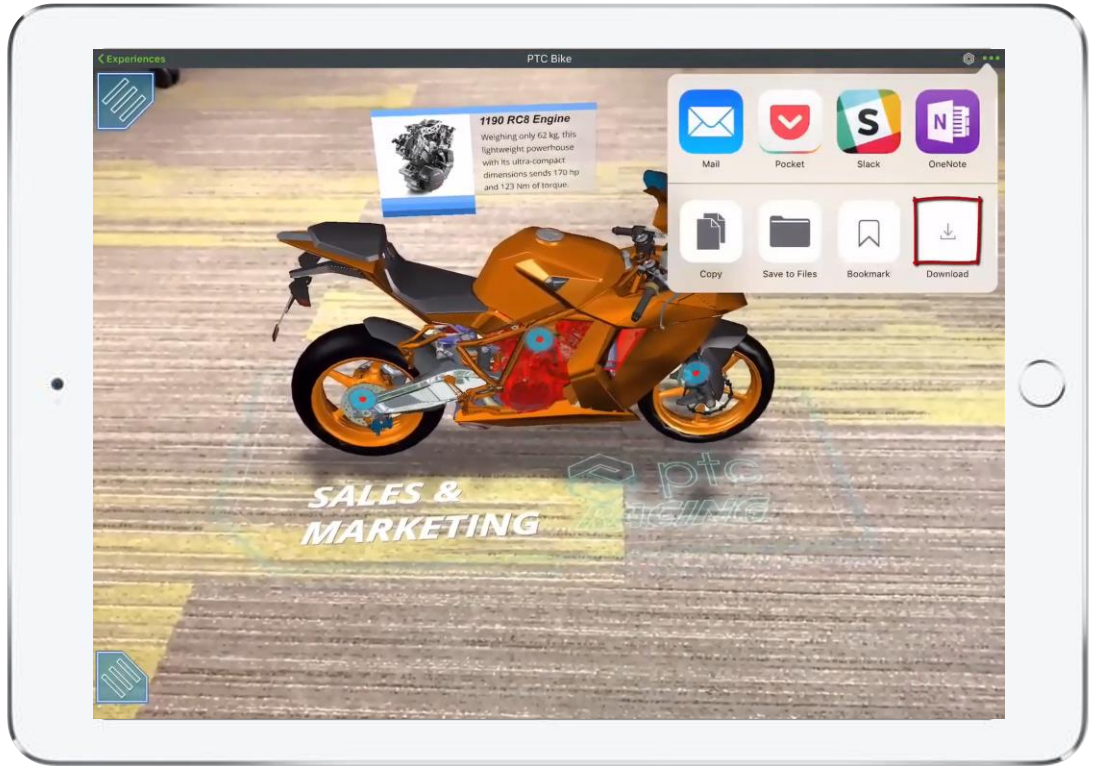
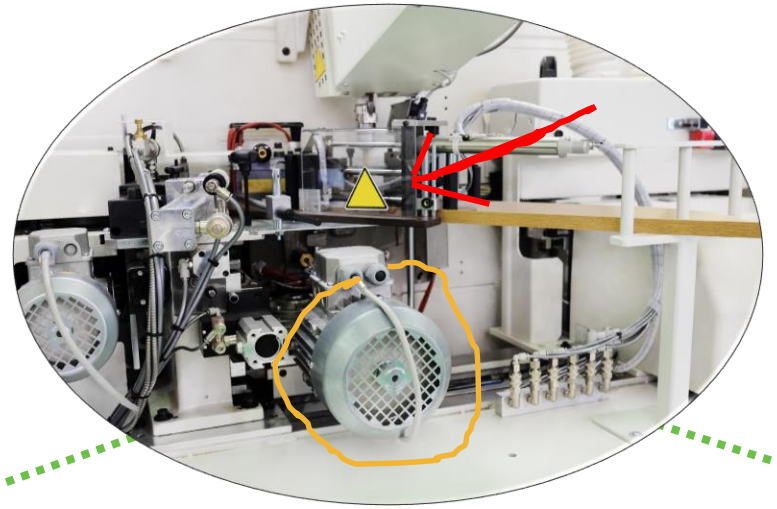


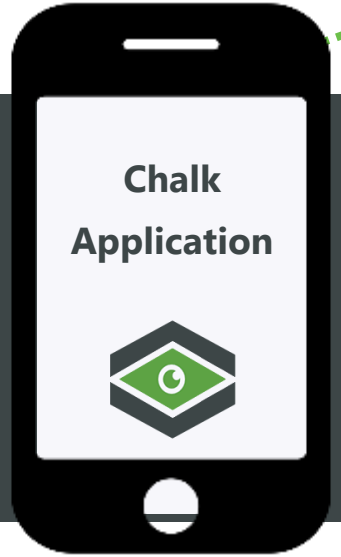


- Available on iOS, Android, Windows 10 and Microsoft HoloLens.

Media #10 – IoT States

EASY-TO-USE, REAL-TIME REMOTE EXPERT GUIDANCE





Vuforia Chalk is an app which connects service technicians or frontline workers with remote experts within their organization.

Media #8 – Remote Expert

ON-GOING PRIORITIES FOR ACHIEVING AR SCALE

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Content Creation

- In-Situ Capturing
  Easier authoring in work context
- Storytelling
  Logic, loops, combination of new and existing content/media
- Seamless re-use of existing 3D content, and procedural guidance

Content Management

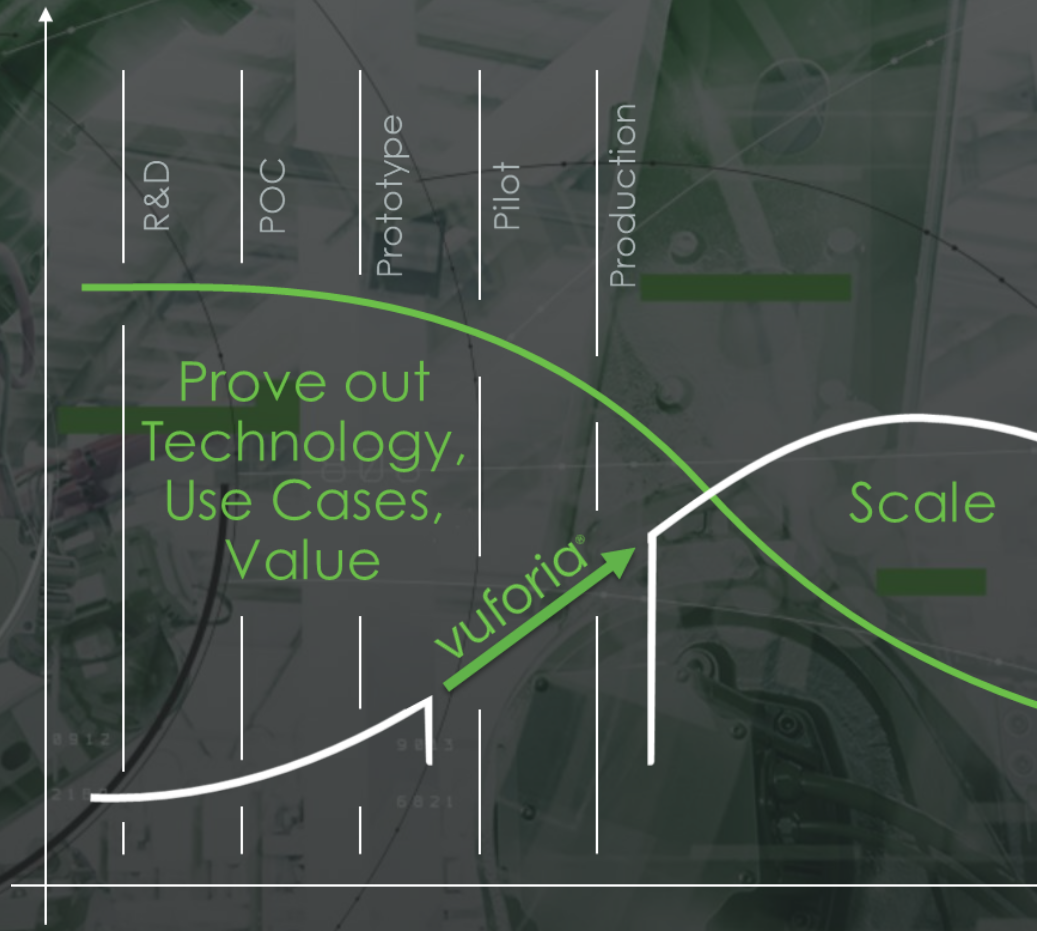
- Scalability, Reuse, Automation
- Better with Microsoft Azure, HoloLens
- Secure & Privacy Controlled
- Manages role-based content
- Enterprise-friendly pricing & packaging

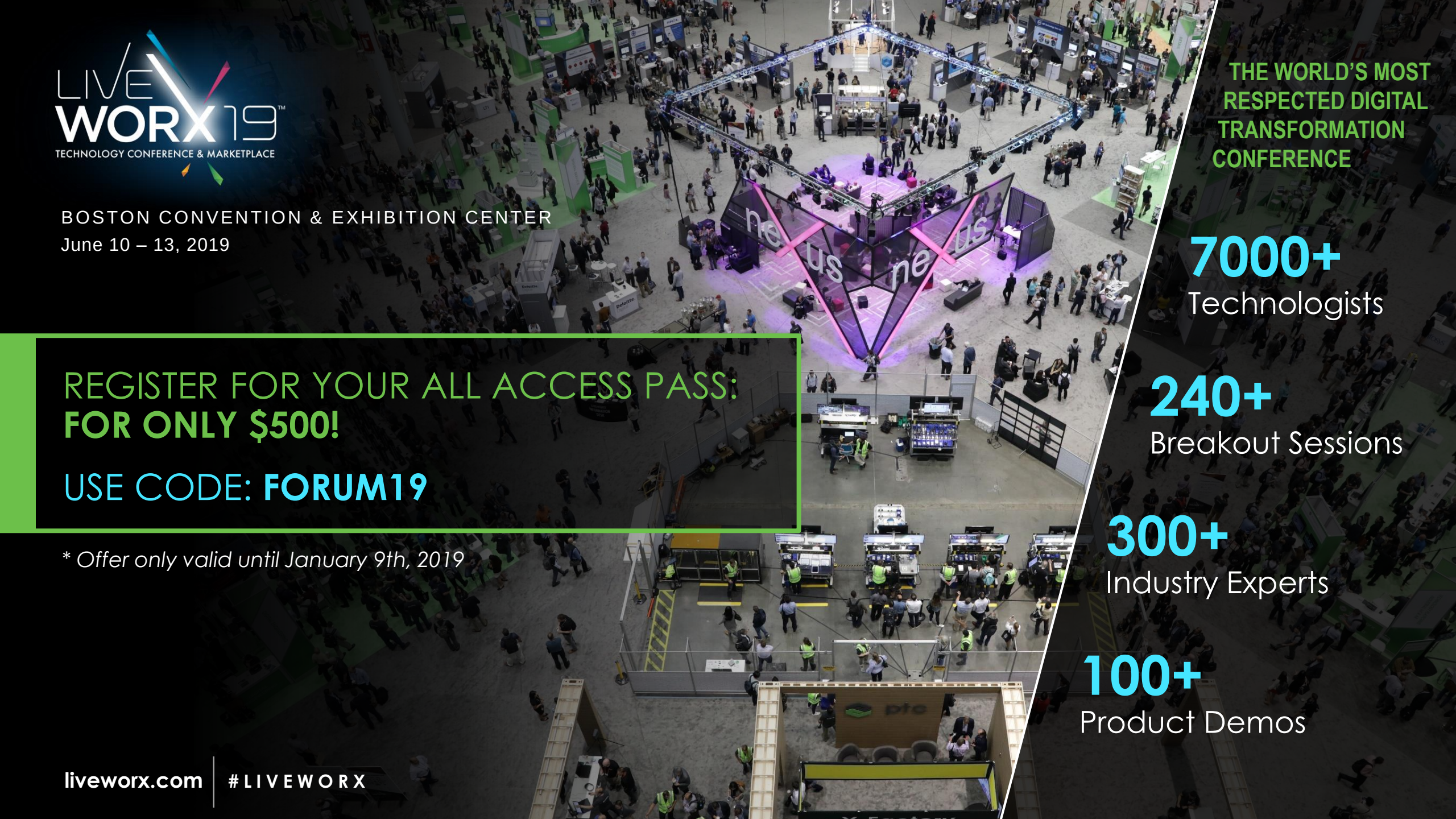
Content Delivery

- Delightful UX, "out-of-the-box"
- Cross-Platform Support, Device-agnostic
- Location-aware; enables Spatial Navigation
- Seamless Remote Expert Guidance
- Embeddable Viewer or Stand-alone App

VUFORIA DELIVERS PROVEN RESULTS TO CUSTOMERS IN MANUFACTURING AND SERVICE

- MARKET-LEADING AR TECHNOLOGY
  - Precise, reliable tracking and computer vision
  - Cross-platform support
- FAST, SCALABLE AR AUTHORING
  - Faster time-to-value with drag and drop AR authoring at scale
  - Create easily-consumable instructions with existing 3D CAD, sequences, IoT data and media content
- INDUSTRIAL EXPERTISE
  - PTC's 30 years of experience serving industrial customers
  - Industry partnerships with Microsoft and Rockwell Automation

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